Claims

1. A spectrometer for analysing a sample produced by an inductively coupled plasma torch in which a normal plasma is created by application of gas to the torch and activation of an induction coil to heat the gas and therefore produce the normal plasma, and which the plasma is capable of collapsing into a toroidal or faulty plasma shape, the spectrometer comprising:

a detector for detecting a change in the plasma from a normal plasma to a toroidal or faulty plasma;

a control section for receiving a signal from the detector for determining change of plasma from the normal plasma shape to the toroidal or faulty plasma shape; and

the control section being for shutting down the torch when the control section determines that the plasma changes from the normal plasma shape to the toroidal or faulty plasma shape.

2. The spectrometer of claim 1 wherein the detector comprises an optical detector which is directed at a position at which the top region of the normal plasma will exist, so that if the normal plasma collapses into a toroidal or faulty plasma, the position of the plasma changes rapidly and the light intensity falling on the optical detector falls, thereby changing the signal produced by the optical detector so that the control section can recognise that the change in shape has occurred.

3. The spectrometer of claim 1 wherein the optical detector is provided with a collimator and/or a lens for increasing the ratio of light received by the optical detector when the normal plasma is in existence, compared to the light intensity when the toroidal or faulty plasma is in existence.

4. The spectrometer of claim 1 wherein an optical fibre or fibres or solid waveguide may be used for conducting light to the optical detector.

5. The spectrometer of claim 3 wherein the optical detector is a photodiode.

6. The spectrometer of claim 1 wherein the detector is an electronic camera with suitable software to analyse the image of the plasma and determine its shape and position to thereby determine if the plasma has collapsed to the toroidal or faulty plasma shape.

7. The spectrometer of claim 1 wherein the detector is a pixel array.

8. The spectrometer of claim 7 wherein the array is a linear photodiode array and the linear photodiode array is provided with a lens.

9. The spectrometer of claim 1 wherein the induction coil includes a generator for generating power to be supplied to the coil to activate the coil, and preferably the control section switches off the generator when the control section determines the change of shape from the normal plasma to the toroidal or faulty plasma shape to shut down the torch.

10. The spectrometer of claim 1 wherein the detector is for determining the impedance value of the plasma in order to determine the change from the normal plasma to the toroidal plasma.

11. The spectrometer of claim 10 wherein the impedance value is provided by measuring the voltage and current of a high voltage DC supply which feeds the generator.